deaths resulting from cardiovascular disorders and infection. Homicide was responsible for the majority of deaths during pregnancy (23 [43.4%]) and during the 43- to 365-day period following delivery or termination of pregnancy (24 [23.3%]), but accounted for only a small proportion of deaths occurring within 42 days of pregnancy (3 [3.6%]), when obstetric causes were responsible for most pregnancy-associated deaths. Cardiovascular disorders (n=21) were the leading cause of death in the 42-day period following delivery or termination of pregnancy and the second leading cause of death (n=18), following homicide, in the late postpartum period (Table 2).

Homicide, the leading cause of pregnancy-associated death, was responsible for 20.2% of all pregnancy-associated deaths. By comparison, homicide was the fifth leading cause of death among Maryland women aged 14 to 44 years who had not had a pregnancy in the year preceding death and was responsible for 457 (6.4%) of total deaths among this group (z=7.737, P<.001). The pregnant group was younger and included a higher percentage of African American women than the nonpregnant group, factors that are associated with higher rates of homicide independent of pregnancy. However, these factors did not explain the higher proportion of homicide deaths in the pregnant group. While adjustment for race and maternal age increased the proportion of deaths due to homicide to 11.2% among women who had not been pregnant in the year preceding death, the adjusted figure was still significantly lower than the figure of 20.2% among women who had been pregnant (z=4.349, P<.001).

COMMENT

The use of multiple data sources substantially enhances pregnancy mortality surveillance because no single source can identify all pregnancy-associated deaths. Death certificates are designed to collect only a small subset of pregnancy-associated deaths. Even these deaths are frequently not included in maternal mortality statistics because physicians completing death certificates fail to provide the information needed to correctly classify a maternal death. Analysis of data in this report indicated that 30 (34.5%) of the 87 deaths meeting the WHO definition of a maternal death could not be identified through cause-of-death information reported by physicians on the death certificate. Data linkage is an additional tool for identifying pregnancy-associated deaths, but it is limited to those deaths with a reported outcome, such as a live birth or fetal death. Medical examiner records are the most useful source for identifying pregnancy-associated deaths among women who have not delivered at the time of death.

Data linkage and review of medical examiner records contribute substantially to identification of pregnancy-associated mortality. In Maryland, this led to the disturbing finding that a pregnant or recently pregnant woman is more likely to be a victim of homicide than to die of any other cause. Other reports have identified homicide as a cause of pregnancy-associated death. However, none of these studies reported on pregnancy-associated deaths from other causes as well, and therefore could not provide a ranking of deaths by cause.

Although we have shown that homicide is responsible for a greater proportion of deaths among pregnant and postpartum women than among women who have not been pregnant in the year preceding death, our findings do not address the issue of whether the homicide rate is higher among pregnant and postpartum women in general than among women who have not had recent pregnancies. This highlights a well-recognized limitation of proportional mortality statistics, ie, that these statistics include only individuals who die, not those at risk of dying. Therefore, no direct inferences regarding increased homicide rates for all pregnant women can be made using only proportional mortality statistics.

The question of whether the homicide rate is higher among pregnant and postpartum women than among women who have not had recent pregnancies could be answered by comparing mortality rates in the 2 groups. However, a methodology for computing pregnancy-associated mortality rates and mortality rates for nonpregnant women has not yet been established because of complexities in determining the number of pregnant women in a population. Since a woman may experience more than 1 pregnancy and more than 1 pregnancy outcome (live birth, fetal loss, or induced abortion) in a given time period, the number of pregnant women cannot be computed by summing the number of pregnancy outcomes. Even if the number of pregnant women could be estimated, an additional issue that would have to be addressed is how to adjust mortality rates to account for differences in the time period of risk of death in the 2 populations. It is important that increased efforts be placed on development of appropriate methodologies for calculating pregnancy-associated mortality rates so that the questions raised by this article may be addressed.

The findings of this article also suggest that maternal mortality review committees should investigate homicides occurring during pregnancy and in the postpartum period to determine potential relationships between these events. For example, a homicide resulting from domestic violence may be related to the stress of pregnancy. Similarly, a suicide soon after delivery may result from postpartum depression. By broadening pregnancy mortality to include all possible causes, factors previously neglected may assume increased importance in prenatal and postpartum care.

Despite the use of enhanced surveillance techniques, it is likely that some pregnancy-associated deaths remain undetected, particularly those occurring in women who were pregnant at the time of death. Since autopsies are performed on all homicide victims, it is more likely that pregnancy would be detected among these women that among women dying from other causes, who are less likely to be autopsied. Since Maryland law mandates that the medical examiner investigate deaths among individuals who were in apparent good health at the time of death, which describes most pregnant women, the majority of deaths among these women should have been investigated by the medical examiner. Autopsies were in fact performed more frequently among women with recognized pregnancy-associated deaths who died from causes other than homicide (123 [62.4%]) than among women of reproductive age without recognized pregnancies (6696 [30.6%]). However, it is still possible that some pregnancies remain undetected, which could have an impact on the total number of pregnancy-associated deaths as well as on the distribution of deaths by pregnancy outcome, time of death, or cause of death.

Efforts are being made in Maryland to improve the identification of pregnancy-associated deaths. Recent legislation mandates that health care professionals and facilities report all pregnancy-associated deaths to the Maryland Maternal Mortality Review Program. In addition, the Maryland death certificate was revised in 2001 to include questions about current or recent pregnancies. Currently, only 17 states and New York City have a pregnancy check box or ask about pregnancy status on their death certificates. Use of pregnancy question by all states on the revised US Standard Certificate of Death has been recommended to the National Center for Health Statistics by the Panel to Evacuate the US Standard Certificates and Reports. Such a change, which would be consistent with a recommendation of the World Health Assembly in the International Classification of Diseases, 10th Revision (ICD–10),[13] would substantially improve ascertainment of pregnancy on death certificates. If approved by the US Department of Health and Human Services, states could adopt the pregnancy question in the 2003 revision of their death certificates. This change should help to identify deaths that remain difficult to detect, such as deaths that cannot be identified through linkage of records and deaths among women who had not delivered that are not reported to the medical examiner. However, it would be a service, as well as good medical practice, if physicians made a greater effort to report pregnancy as a factor contributing to death when appropriate.

Comprehensive identification of pregnancy-associated deaths can only be accomplished by collecting information from multiple data sources and including all deaths occurring up to 1 year after pregnancy termination. Through such enhanced surveillance, the Maryland Department of Health and Mental Hygiene has shown that the number of pregnancy-associated deaths is substantially higher and causes of death substantially broader than previously believed. Enhanced surveillance of pregnancy-associated deaths is necessary to accurately document the magnitude of pregnancy mortality, identify groups at increased risk of death, review factors leading to the death, and plan prevention strategies. It is therefore a critical step in the reduction of pregnancy-associated mortality.

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